CLAIMS

What is claimed is:

1. A material comprising: a porous substrate comprised of a polymer and a functional additive and having a surface, wherein the surface comprises a region defined by at least some of the functional additive; and a biological or chemical moiety covalently or non-covalently bound to the region.

2. The material of claim 1, wherein the surface comprises a plurality of regions defined by at least some of the functional additive, each of which is covalently or non-covalently bound to a chemical or biological moiety.

3. A material comprising: a porous substrate comprised of a polymer and a functional additive and having a surface, wherein the surface comprises a region defined by at least some of the functional additive; a spacer covalently bound to the region; and a biological or chemical moiety covalently or non-covalently bound to the spacer.

4. The material of claim 3, wherein the surface comprises a plurality of regions defined by at least some of the functional additive, each of which is covalently bound to a spacer, which in turn is covalently or non-covalently bound to a biological moiety.

5. The material of claim 1 or 3, wherein the polymer is a polyolefin, polyether, nylon, polycarbonate, poly(ether sulfone), or a mixture thereof.

6. The material of claim 5, wherein the polyolefin is ethylene vinyl acetate; ethylene methyl acrylate; polyethylenes; polypropylenes; ethylene-propylene rubbers; ethylene-propylene-diene rubbers; poly(l-butene); polystyrene; poly(2-butene); poly(1-pentene); poly(2-pentene); poly(3-methyl-1-pentene); poly(4-methyl-1-pentene); 1,2-poly-1,3-butadiene; 1,4-poly-1,3-butadiene; polyisoprene; polychloroprene; poly(vinyl acetate); poly(vinylidene chloride); poly(tetrafluoroethylene) (PTFE);

poly(vinylidene fluoride) (PVDF); acrylonitrile-butadiene-styrene (ABS); or a mixture thereof.

7. The material of claim 5, wherein the polyolefin is polyethylene or polypropylene.

8. The material of claim 5, wherein the polyether is polyether ether ketone (PEEK, poly(oxy-1,4-phenylene-oxy-1,4-phenylene-carbonyl-1,4-phenylene)), polyether sulfone (PES), or a mixture thereof.

9. The material of claim 1 or 3, wherein the functional additive comprises a hydroxyl, carboxylic acid, anhydride, acyl halide, alkyl halide, aldehyde, alkene, amide, amine, guanidine, malimide, thiol, sulfonate, sulfonic acid, sulfonyl ester, carbodiimide, ester, cyano, epoxide, proline, disulfide, imidazole, imide, imine, isocyanate, isothiocyanate, nitro, or azide functional group.

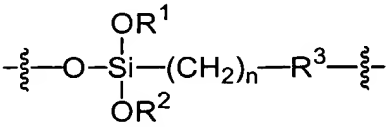
10. The material of claim 9, wherein the functional additive comprises a hydroxyl, amine, aldehyde, or carboxylic acid functional group.

11. The material of claim 10, wherein the functional additive comprises a hydroxyl functional group.

12. The material of claim 1 or 3, wherein the functional additive is silica powder, silica gel, chopped glass fiber, controlled porous glass (CPG), glass beads, ground glass fiber, glass bubbles, kaolin, alumina oxide, or a mixture thereof.

13. The material of claim 3, wherein the spacer is a silane, functionalized silane, diamine, alcohol, ester, glycol, anhydride, dialdehyde, terminal difunctionalized polyurethane, dione, macromer, or a multifunctional polymer.

14. The material of claim 13, wherein the spacer to which the porous substrate and biological or chemical moiety is attached is of Formula I:

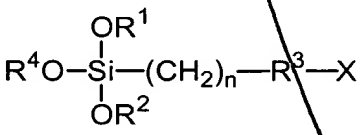


Formula I

wherein the substrate is bound to the oxygen atom and the chemical or biological moiety is bound to R^3; R and R' each independently is hydrogen, substituted or unsubstituted alkyl, aryl, or aralkyl; R^3 is a substituted or unsubstituted aliphatic chain or a bond; and n is an integer from about 1 to about 18.

15. The material of claim 1 or 3, wherein the chemical or biological moiety is a drug, hydrophilic moiety, catalyst, antibiotic, antibody, antimycotic, carbohydrate, cytokine, enzyme, glycoprotein, lipid, nucleic acid, nucleotide, oligonucleotide, peptide, protein, ligand, cell, ribozyme, or a combination thereof.

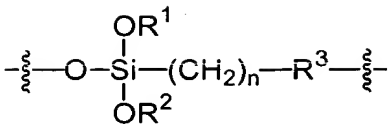
16. A material comprising a porous polyethylene substrate having a surface in which a functional additive has been embedded, and a spacer precursor of Formula II covalently attached to at least a portion of said functional additive:



Formula II

wherein R^1, R^2 and R^4 each independently is hydrogen, substituted or unsubstituted alkyl, aryl, or aralkyl; R^3 is a substituted or unsubstituted aliphatic chain or a bond; n is an integer from about 1 to about 18; and X is OH, NH_2, CHO, CO_2H, NCO ,or epoxy.

17. A material comprising a porous polyethylene substrate having a surface in which a functional additive has been embedded, and a spacer of Formula I:



Formula I

wherein R and R' each independently is hydrogen, substituted or unsubstituted alkyl, aryl, or aralkyl; R^3 is a substituted or unsubstituted aliphatic chain or a bond; and n is an integer from about 1 to about 18, covalently attached to at least a portion of said functional additive and to a chemical or biological moiety.

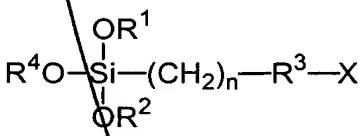
18. The material of claim 17, wherein the chemical or biological moiety is a nucleotide, oligonucleotide, polynucleotide, peptide, cell, ligand, or protein.

19. A method of providing a material which comprises: forming a porous substrate comprised of a polymer and a functional additive and having a surface, wherein the surface comprises a region defined by at least some of the functional additive, wherein the region contains at least one functional group; contacting the functional group with a spacer under reaction conditions suitable for the formation of a covalent bond between an atom of the functional group and an atom of the spacer; and contacting the spacer with a chemical or biological moiety under reaction conditions suitable for the formation of a covalent or non-covalent bond between an atom of the spacer and an atom of the chemical or biological moiety.

20. The method of claim 19, wherein the functional group is hydroxyl, carboxylic acid, anhydride, acyl halide, alkyl halide, aldehyde, alkene, amide, amine, guanidine, malimide, thiol, sulfonate, sulfonic acid, sulfonyl ester, carbodiimide, ester, cyano, epoxide, proline, disulfide, imidazole, imide, imine, isocyanate, isothiocyanate, nitro, or azide.

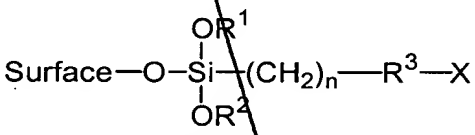
21. The method of claim 19, wherein the porous substrate is formed by sintering beads and then attaching the spacer, or attaching the spacer to beads prior to sintering the beads.

22. A method of providing a material which comprises: forming a porous substrate comprised of a polymer and a functional additive and having a surface, wherein the surface comprises a region defined by at least some of the functional additive, wherein the region contains at least one hydroxyl group; and contacting the hydroxyl group with a compound of Formula II:



Formula II

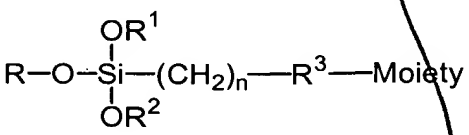
wherein each of R^1, R^2, and R^4 each independently is hydrogen, substituted or unsubstituted alkyl, aryl, or aralkyl; R^3 is a substituted or unsubstituted aliphatic chain or a bond; n is an integer from about 1 to about 18; and X is OH, NH_2, CHO, CO_2H, NCO, or epoxy under conditions suitable for the formation of a material of Formula III:



Formula III

wherein Surface is the surface of the porous substrate.

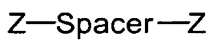
23. The method of claim 22 wherein the material of Formula III is contacted with a chemical or biological moiety having an amine group if X is an aldehyde or carboxylic acid, or a chemical or biological moiety having an aldehyde or carboxylic acid group if X is an amine, under reaction conditions suitable for the formation of a material of Formula IV:



Formula IV

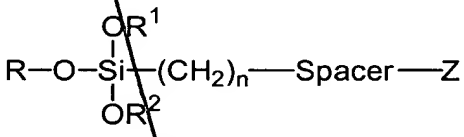
wherein Moiety is the chemical or biological moiety.

24. The method of claim 22 wherein the material of Formula III, X is NH_2 and is contacted with a compound of Formula V:



Formula V

wherein Spacer is a hydrophilic segment and Z is a terminal group capable of covalently or non-covalently bonding to proteins, amino acids, oligonucleotides, under reaction conditions suitable for the formation of a material of Formula VI:



Formula VI

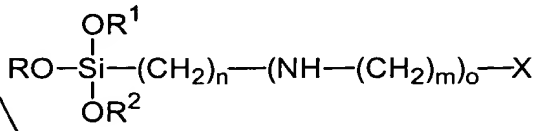
wherein R is the surface of the porous substrate.

25. The method of claim 24, wherein Spacer is a hydrophilic polyurethane, polyethylene glycol, or polyelectrolyte and wherein Z is isocyanurate, aldehyde, amino, carboxylic acid, or N-hydroxysuccimide.

26. A method of controlling the functionalization of a sintered polyolefin substrate which comprises: forming a mixture of polyolefin particles and particles of a functional additive; and sintering the mixture; wherein the functional additive comprises functional groups and the concentration of functional additive in the mixture is approximately proportional to the density of functional groups on a surface of the sintered polyolefin substrate.

27. The method of claim 26, wherein the functional additive is silica powder, silica gel, chopped glass fiber, controlled porous glass (CPG), glass beads, ground glass fiber, glass bubbles, kaolin, alumina oxide, or a mixture thereof.

28. The material of claim 13 wherein the spacer to which the porous substrate and biological or chemical moiety is attached is of Formula VIII:

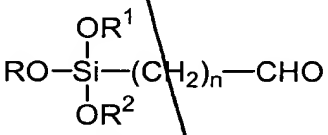


Formula VIII

wherein R is the surface of the porous substrate; R^1 and R^2 each independently is hydrogen, substituted or unsubstituted alkyl, aryl, or aralkyl; X is OH, NH_2, CHO, CO_2H, NCO, or epoxy; n is an integer from about 1 to about 5; m is an integer from about 1 to about 5; and o is an integer from 0 to about 3.

29. The material of claim 25 wherein X is CHO or NH_2.

30. The material of claim 13 wherein the spacer to which the porous substrate and biological or chemical moiety is attached is of Formula IX:



Formula IX

wherein R is the surface of the porous substrate; R^1 and R^2 each independently is hydrogen, substituted or unsubstituted alkyl, aryl, or aralkyl; and n is from about 1 to about 18.